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SEA402517

PSI Environmental Geotechnical Construction
Consulting • Engineering • Testing

Formerly Pacific Testing Laboratories

July 15, 1998

Mr. Jeff Winter, P.E.
KING COUNTY INTERNATIONAL AIRPORT
P.O. Box 80245
Seattle, Washington 98108

Subject: Report of Geotechnical Investigation
N.E. T-Hanger Site
King County International Airport
Seattle, Washington
PSI Project No. 712-80129

Dear Mr. Winter:

Professional Service Industries, Inc. (PSI) is pleased to provide you with our geotechnical study report for the subject project. This report presents the results of our field investigation completed on June 24, 1998 and our engineering analyses. Our scope of work is based on our proposal to you, dated June 10, 1998.

Thank you for considering PSI to provide the required geotechnical engineering services. If you have any questions, please contact us at (206) 282-0666.

Respectively Submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Sam Yaghmaie, P.E.
Manager, Construction Services
Department

Prepared by:
Leonard J.Costa, II
Staff Geotechnical Engineer

GEOTECHNICAL INVESTIGATION
N.E. T-HANGER SITE
KING COUNTY INTERNATIONAL AIRPORT
SEATTLE, WASHINGTON

Submitted to:

KING COUNTY INTERNATIONAL AIRPORT
P.O. Box 80245
Seattle, Washington 98108

Submitted by:
PROFESSIONAL SERVICE INDUSTRIES, INC.
3257 16th Avenue West
Seattle, Washington 98119-1706

July 15, 1998
PSI Project No. 712-80129

KING COUNTY INTERNATIOAL AIRPORT
PSI Project No. 712-80129
July 15, 1998
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1.0 INTRODUCTION

This report presents the results of our geotechnical study for three proposed metal T-hangers to be constructed at the north end of King County International Airport in Seattle, Washington. The purpose of our services was to evaluate the subsurface conditions within the site and provide geotechnical recommendations for design and construction of the proposed project. Our services were performed in general accordance with our proposal dated June 10, 1998.

2.0 SITE AND PROJECT DESCRIPTION

The project site is located at the north end of King County International Airport in Seattle, Washington. The site is within a generally level area. At the time of the PSI site investigation five existing hangars occupied the site. The hangars are rectangular and occupy an area of approximately 4500 square feet each. The hangars are surrounded by asphalt pavements. The site is rectangular and oriented in a northwest-southeast direction. The site is bordered to the northeast by Perimeter Road and Airport Way, to the north by a helicopter terminal, to the northwest by a tarmac, to the west and southwest by Taxiway "A" of the airport facilities and to the southeast by a tarmac. The location of the site is shown on the Vicinity Map, Figure 1.

Based on the information provided by King County, we understand that the project will consist of demolishing the five existing hangars previously mentioned and constructing three metal "T" hangars on spread footing foundations. The proposed hangars will be rectangular structures with foot prints varying from 5,106 to 15,494 square feet and will be located towards the southeast portion of the site. A 25,000 square foot hangar is planned for the future within the north portion of the site. The remaining portions of the site will be covered with asphalt pavements. Final site grades are anticipated to remain at or near existing levels and additional fill placement on the site will likely be minimal.

3.0 LOCAL GEOLOGY

The subject site is located in the Duwamish River Basin, made up of alluvium and fill which are mostly sands and silts. The area is interbedded with peat and muck. Geological publications describe this area as having fair foundation stability and poor seismic stability. Water runoff is poor due to the slope of the area and the water table is near the surface.

4.0 SITE INVESTIGATION

On June 24, 1998 a representative of PSI observed the drilling of six test borings (1 through 6). The boring locations actually drilled are shown on the Site Plan, Figure 2. The soil borings were drilled to depths varying from 14.5 to 39.5 feet using a truck mounted drill rig equipped with a 4-inch internal diameter hollow-stem auger. The depth of each boring is recorded on the boring logs in Appendix A. The three shallow borings were drilled for environmental observations. The three deeper borings were drilled for geotechnical analysis.

Standard Penetration Tests (SPT) were performed at 5-foot intervals, except near the surface where tests were performed at 3-foot intervals. The SPT's in the soil borings provide a means of collecting soil samples at selected depths and determining soil consistency. The SPT consists of driving a 2-inch (outside diameter) split-spoon sampler a distance of 18 inches into the bottom of the borehole with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler each of three 6-inch increments was recorded. The number of blows required to drive the last 12 inches is the Standard Penetration Resistance (N-value).

After performing each SPT, the split-spoon sampler was removed from the borehole, and each soil sample classified and logged by the PSI staff engineer. Soil samples were visually examined in the field for preliminary classification according to the Unified Soils Classification System. The borings were then backfilled with soil cuttings from the borings and supplemented with bentonite chips.

5.0 SITE SOIL CONDITIONS

The site is covered by asphalt pavements with an underlying silty sand fill to approximately 5 feet. This fill is underlain by intermittent layers of medium grained and fine grained silty sands to approximately 23 feet and by a soft sandy silt to a depth of 29 feet. This was in turn underlain by a medium dense to dense silty sand. For a more thorough description of soil conditions encountered, please refer to the Boring Logs in Appendix A.

Groundwater was encountered at an average depth of six feet during drilling operations. However, it should be noted that groundwater levels will vary seasonally with rainfall and other factors.

An environmental sample was taken from each boring at or near the groundwater level. These samples were collected for analysis of Total Petroleum Hydrocarbons (TPH) by method WTPH-HCID to determine if fuel contamination was present. All soil samples were screened upon opening with a photoionization detector (PID), which provides a qualitative assessment of total volatile organic constituent concentration in the sample.

Soil samples selected for laboratory chemical analysis were immediately contained in labeled, laboratory-prepared glass jars and placed in a chilled cooler for storage and transported to the laboratory using chain-of-custody procedures. The soil samples were submitted to the North Creek Analytical laboratory in Bothell, Washington for screening analysis of Total Petroleum Hydrocarbons (TPH) by method WTPH-HCID.

6.0 ANALYSES

The site is generally suitable for the proposed construction provided the site is properly prepared. The soils generally consist of medium dense to dense silty sands and an underlying layer of soft sandy silt. We also mentioned that the groundwater was at an average depth of six feet. Based on the depth of the explorations and site conditions, groundwater may have an impact on the

proposed construction. Additional comments and recommendations are provided in the following sections.

7.0 RECOMMENDATIONS

The following sections present our recommendations for Site Preparation and General Earthwork, Conventional Footings, Slab-on-Grade Floors, Retaining Walls, Seismic Design Considerations, Site Drainage, Erosion Potential, and Pavement Areas.

7.1 Site Preparation and General Earthwork

Prior to any earthwork, the proposed construction areas of each hangar should be stripped of all surface materials. Most of these materials consist of asphalt and the underlying gravel support. Gravel materials can be stockpiled for later use as structural fill. The concrete of the slabs and footings of the existing hangars can also be used if the concrete is broken down into small pieces not exceeding four inches. Any other construction debris and stripped soil should be disposed of. Soil from the stripping operation may not be suitable for use as structural fill. Any old fill that has not been properly compacted and encountered below the building pad should be removed and replaced with structural fill.

After stripping of surficial materials, the site should be observed by a representative of PSI. At that time the exposed subgrade should be proof-rolled with a heavily loaded rubber-tired vehicle. Subrade soils which contain excessive organics, or which deflect significantly during the proof-rolling should be overexcavated to a firm native soil and backfilled with compacted structural fill.

Structural fill is defined as any compacted fill placed under buildings, roadways, slabs, pavements, or any other load-bearing areas. Structural fill located under footings and floor slabs should be placed in horizontal lifts not exceeding 12 inches in loose thickness and compacted to at least 95 percent of its laboratory maximum dry density, determined in accordance with ASTM Test Designation D-1557 (Modified Proctor). The fill materials should be placed at or within 2 percent of the optimum moisture content. Fill under pavements and walks should also be placed in horizontal lifts and compacted to 90 percent of maximum density, except for the top 4 feet which should be compacted to at least 95 percent of maximum density.

7.2 Conventional Footings

The proposed structures may be founded on a system of shallow spread footing foundations and independent footings. The footings should be founded on competent native soil or structural fill which has been compacted to at least 95 percent of the laboratory standard. As materials within the site exhibited significant variation in composition and consistency we strongly recommend that all footing excavations be inspected prior to placing concrete footings. If exposed soils are soft or become unstable during construction, we recommend over-excavation of the unstable soils and replacement with structural fill.

Conventional spread footings supported on dense native soil or properly placed structural fill, as recommended above, may be designed using an allowable bearing capacity of 2,500 pounds per square foot (psf) founded at a minimum depth of 18 inches. We recommend that continuous footings have a minimum width of 18 inches and individual footings a minimum width of 36 inches.

Post construction settlements are anticipated to be minor. Based on the assumed loads, total settlements of less than 1 inch and differential settlements of less than 0.25 inches per 20 feet are anticipated for structures placed on dense native soil or structural fill. Most of the settlements are anticipated to occur during construction as dead loads are applied.

Lateral loads can be resisted by friction between the foundation and the compacted fill subgrade, or by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with a compacted fill meeting the requirements of structural fill. The following design parameters may be used for lateral resistance of walls and footings founded in structural fill or dense native soil:

Passive pressure	=	300 pounds per cubic foot (pcf)
Coefficient of friction	=	0.40

The above values include a factor of safety of 1.5. A one-third increase in allowable bearing capacity may be utilized for short-term loads, such as in the case of a seismic event or wind loading.

We recommend that a PSI soils engineer inspect all footing excavations prior to concrete placement to assure adequate bearing capacity conditions have been achieved. If loose or soft soil conditions are encountered, these soils should be compacted or removed and replaced with structural fill.

7.3 Slab-on-Grade Floors

Slab-on-grade floor areas should be heavily proof-rolled to verify a firm, non-yielding condition. If soft or loose soils are encountered, they should be recompacted or removed and replaced with structural fill.

After proof-rolling, the building slab areas should be provided with a capillary break material consisting of 4 inches of clean building sand or clean fine gravel. This material should be free-draining and contain less than 3 percent fines. We would also recommend the utilization of a vapor barrier such as a 6-millimeter thick plastic membrane to prevent moisture build-up beneath the concrete slab. Up to two inches of damp sand may be placed over the membrane for protection during construction and to aid in curing of the concrete.

7.4 Seismic Design Considerations

The Seattle area is classified as a Seismic Zone 3 by the Uniform Building Code (UBC). Based on

our analysis of on-site explorations, we interpret the subsurface site conditions to correspond to a seismic soil profile S_D, as defined by Table 16-J of the 1997 UBC. Soil Profile type S_D applies to a profile consisting of predominantly soil conditions less than 200 feet thick.

Structures are subject to damage from earthquakes due to either direct shaking or by foundation soil failures. Of these, most damage results from liquefaction where soil loses strength and settles rapidly as a result of dynamic forces. Based upon the quantity of silt present in the soil and the medium dense condition of the soil strata, the risk of liquefaction is considered to be low to moderate at this site.

7.5 Site Drainage

We recommend the installation of footing drains around the perimeters of the building foundations. The drains should consist of 4-inch-diameter perforated PVC pipe placed in a bed of pea gravel located at the invert elevation of the footing. The perforated drain lines should then be tightlined to a storm drain system.

Roof downspouts should also be tightlined to discharge into the existing storm drain system. Cleanouts should be installed at strategic locations to allow for periodic maintenance of the downspout tightline systems.

The site should be graded such that surface water is directed away from the building and pavement areas. Water must not be allowed to stand in any area where footings, slabs, or pavements are to be constructed. During construction, loose surfaces should be sealed at night by compacting the surface to reduce the potential for moisture infiltration into the soils. Final site grades must allow for drainage away from the building foundations. We suggest that paved surfaces be sloped at a gradient of 1 percent for a distance of at least 10 feet away from the building. Unpaved areas should be sloped at a surface gradient of 3 percent.

7.6 Erosion Potential

Based on the encountered soil type and site topography, there appears to be a low potential for erosion. However, all permanent cut and fill slopes should be protected so that erosion will not occur. Thus, unprotected permanent cut and fill areas should be laid back at a slope of not more than 2H:1V and hydroseeded at the earliest opportunity (or planted with suitable ground cover, preferably using indigenous shrubs).

7.7 Pavement Areas

The adequacy of site pavements is related to the condition of the underlying subgrade. To provide a properly prepared subgrade for pavements, the top four feet of the subgrade should be compacted to at least 95 percent of the maximum dry density (per ASTM D-1557). The recommended pavement thickness used will vary depending on the structural fill material used below the pavement, and the traffic type and volume. In selecting a pavement type, it should be

noted that Portland Cement Concrete generally has less maintenance and greater longevity than Asphalt Concrete.

The following pavement section for lightly-loaded areas can be used:

- Four inches of Portland Cement Concrete over 6 inches of crushed rock base (CRB) material, or
- Four inches of Portland Cement Concrete over 3 inches of asphalt treated base (ATB) material, or
- Four inches of Asphalt Concrete (AC) over 6 inches of CRB material, or
- Four inches of AC over 3 inches of ATB material.

Heavier truck-traffic areas will require thicker sections depending upon site usage, pavement life, and site traffic. As a general rule, you may consider for truck-traffic areas the following sections:

- Five to six inches of Portland Cement Concrete over 10 inches of CRB, or
- Five to six inches of Portland Cement Concrete over 5 inches of ATB.
- Five to six inches of AC over 10 inches of CRB, or
- Five to six inches of AC over 5 inches of ATB.

Additionally, placement of an appropriate nonwoven geofabric to separate the aggregate base from the native soil would be recommended in areas where truck traffic is concentrated. We will be pleased to assist you in developing appropriate pavement sections for heavy traffic zones and specific specific geofabric recommendations, if needed.

8.0 ENVIRONMENTAL MONITORING RESULTS

Six soil samples were selected (one from each boring) for laboratory chemical analysis of Total Petroleum Hydrocarbons (TPH) by method HCID (Hydrocarbon Identification). Since no significant indication of volatile hydrocarbons was detected using the PID, and no visible indication of hydrocarbon product was noted, soil samples were selected for analysis from near the level of the water table (about 6 feet deep) in each boring. The laboratory analytical results for the soil TPH Hydrocarbon Identification are listed in Table 1, and the laboratory report is presented in Appendix C.

One of the samples, from boring B-4 located in the northwest corner of the site, contained detectable levels of diesel-range and heavy oil-range hydrocarbon. This sample was reanalyzed using method WTPH-Diesel, extended range, to quantify the detected TPH levels in the sample. These results are listed in Table 2. Both diesel and heavy oil-range concentrations were above the Method A Cleanup Level (200 parts per million, ppm) established by the Washington Model Toxics Control Act (MTCA). The other five soil samples contained no detectable levels of TPH. The extent of the hydrocarbon cannot be determined with the available data, although it appears likely that the hydrocarbon is not present within the proposed construction area for the three hangers.

TABLE 1
SUMMARY OF SOIL TOTAL PETROLEUM HYDROCARBON ANALYSES

Sample No.	Date Sampled	Depth Interval (ft)	WTPH-HCID (ppm)		
			Gasoline Range	Diesel Range	Oil Range
B-1/S-2	6/24/98	5.0 - 6.5	<20.0	<50.0	<100
B-2/S-2	6/24/98	5.5 - 7.0	<20.0	<50.0	<100
B-3/S-2	6/24/98	5.5 - 7.0	<20.0	<50.0	<100
B-4/S-2	6/24/98	5.5 – 7.0	<20.0	**>50.0**	**>100**
B-5/S-1	6/24/98	5.5 – 7.0	<20.0	<50.0	<100
B-6/S-2	6/24/98	8.0 - 9.5	<20.0	<50.0	<100
MTCA Method A Cleanup Levels in ppm.			**100**	**200**	**200**

TABLE 2
SOIL TOTAL PETROLEUM HYDROCARBON QUANTIFICATION ANALYSIS

Sample No.	Date Sampled	Depth Interval (ft)	WTPH-Dx (ppm)	
			Diesel Range	Heavy Oil Range
B-4/S-2	6/24/98	5.5 - 7.0	**552**	**3,840**
MTCA Method A Cleanup Levels in ppm.			**200**	**200**

9.0 LIMITATIONS

The recommendations submitted, in this report, are based on the site investigation conducted by PSI and design details that have been provided to PSI. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not notified of such changes, PSI will not be responsible

for the impact of those changes on the project.

PSI warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

This report has been prepared for the exclusive use of the King County International Airport, and its contractors for the specific application to the proposed project. The reproduction of this report, except in full, by any method and its transmittal by any means to a third party without the written permission of PSI, is prohibited. This report, in its entirety, should be included in the project contract documents for the information of the contractor.

Respectively Submitted,

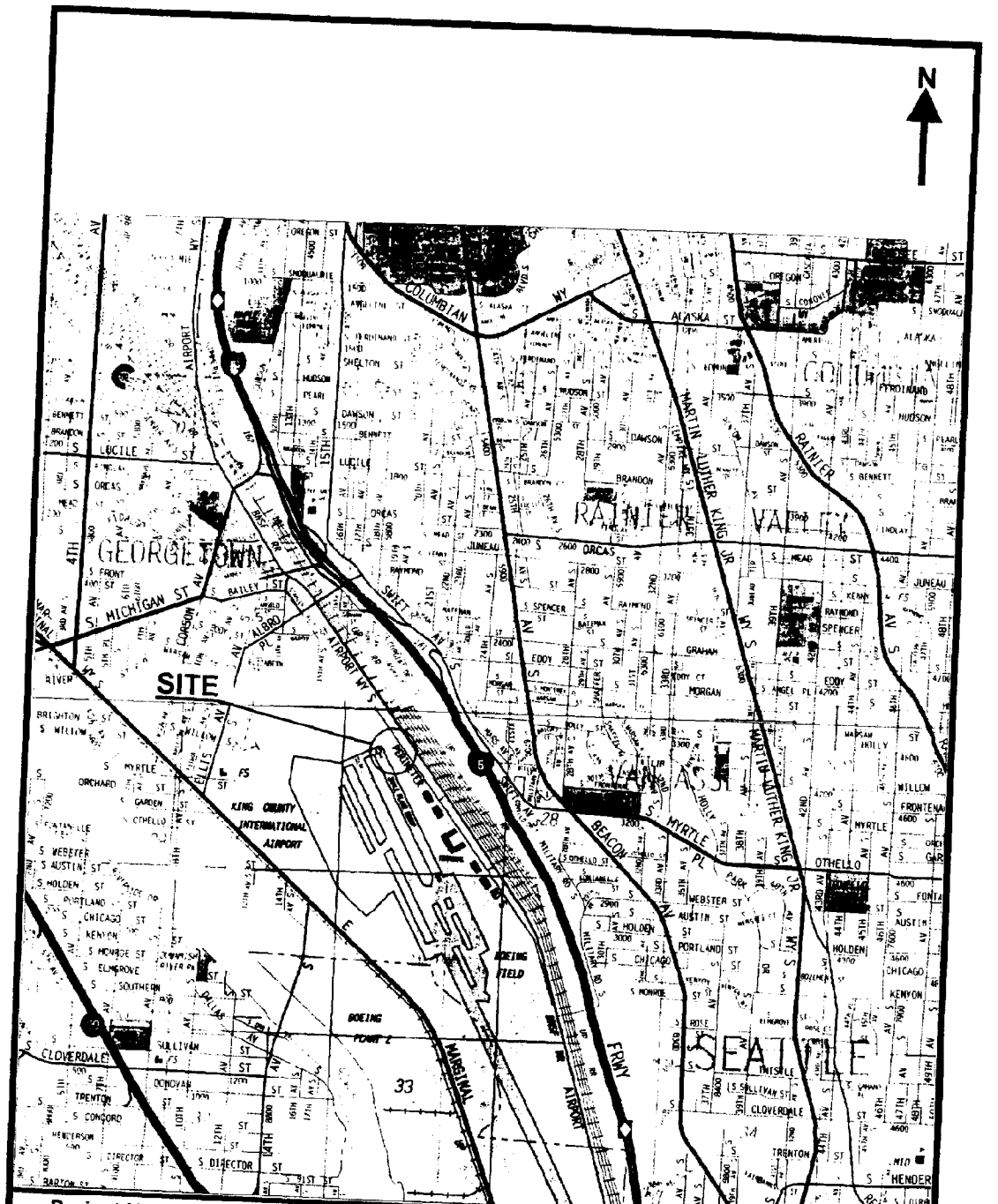
PROFESSIONAL SERVICE INDUSTRIES, INC.

Sam Yaghmaie, P.E.
Manager, Construction Services Department

Prepared by:
Leonard J. Costa, II
Staff Geotechnical Engineer

Reviewed by: James Niehoff, P.E., Senior Author Geotechnical Services

FIGURES



Project No.: 712-80129	VICINITY PLAN	*PSI, Inc.*
Date: 7/10/98	NTS	3257 16th Avenue W.
Drawn by: LJC	King Co. International Airport	Seattle, WA
Ckecked by: S. Yaghmaie	Seattle, WA	Figure 1

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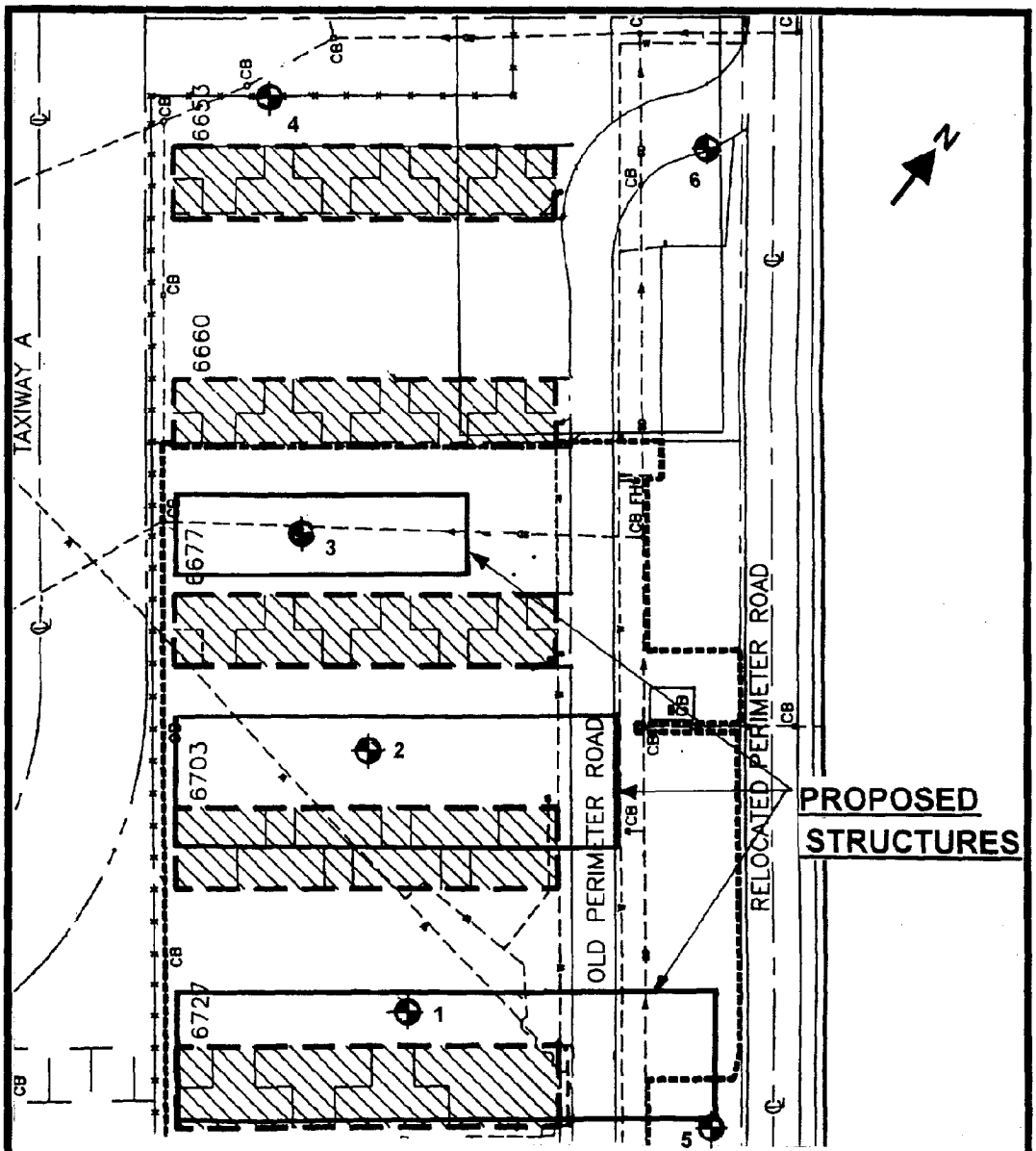
SEA402531



Legend:

1 -Approximate location & number of boring

Reference:

Site Demolition Plan
N.E. T - Hangars
King County International Airport
By: D. Spencer/J. Winter
Dated: 6/3/96

Project No.: 712-80129	SITE PLAN	*PSI, Inc.*
Date: 7/10/98	1" = 80'	3257 16th Avenue W.
Drawn by: LJC	King Co. International Airport	Seattle, WA
Ckecked by: S. Yaghmaie	Seattle, WA	Figure 2

KCSlip4 35987

SEA402532

APPENDIX A

BORING LOGS

BORING LOG NO. 1

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL	MOISTURE CONTENT (%)
					0.25	3 inch ASPHALT pavement	
						Brown, silty, sandy GRAVEL; dense, moist (base coarse)	
			SPT 1A	2	3		
					3.5	Dark brown, sandy SILT; firm, moist	27.0
			SPT 1B	6-7		Dark gray, silty SAND; medium dense, moist, fine grained	
5					5		16.8
			SPT 2	4-7-11		changes to medium grained	24.0
					8		
			SPT 3	2-8-9		changes to fine grained, dense	27.1
10							
			SPT 4	4-7-17			25.2
15							
			SPT 5	11-19-18			22.8
20							
					23		
			SPT 6	2-7-12		changes to medium dense	31.3
25							
			SPT 7	5-14-21			33.1
30					30	Boring completed at 30.0 feet on June 24, 1998; Groundwater encountered at 6.0 feet.	
35							

COMPLETION DEPTH: 30.0 **DEPTH TO WATER IN BORING:** 6.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 71280122.GPJ MINE.GDT 7/13/98

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SEA402534

BORING LOG NO. 2

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL	MOISTURE CONTENT (%)
					0.25	3 inch ASPHALT pavement	
						Dark gray, silty SAND; medium dense, moist, fine grained (fill)	
		X	SPT 1	4-5-6			14.1
5					5	Dark gray, silty SAND; medium dense, wet, medium grained (native)	
		X	SPT 2	3-5-7			24.8
		X	SPT 3	3-6-7	8	changes to fine grained	24.5
10							
		X	SPT 4	5-14-18	13	changes to medium grained	23.5
15							
		X	SPT 5	8-13-19			26.5
20							
		X	SPT 6	1/12"-2	23	Dark gray, sandy SILT; soft, wet	39.7
25							
		X	SPT 7	3-9-10	29	Dark gray, silty SAND; medium dense, wet fine grained	35.6
30					30	Boring completed at 30.0 feet on June 24, 1998; Groundwater encuontered at 6.0 feet.	
35							

COMPLETION DEPTH: 23.5 **DEPTH TO WATER IN BORING:** 6.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 71280122.GPJ MINE.GDT 7/13/98

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SEA402535

BORING LOG NO. 3

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL	MOISTURE CONTENT (%)
					0.25	3 inch ASPHALT pavement	
						Dark brown, silty SAND; medium dense, moist (fill)	
		X	SPT 1	5-6-8			13.2
5					5	Dark gray, silty SAND; medium dense, wet, medium grained (native)	
		X	SPT 2	4-4-5			26.3
		X	SPT 3	4-7-11			22.4
10							
		X	SPT 4	5-15-30	13	changes to dense	24.1
15							
		X	SPT 5	7-21-50	18	changes to very dense, fine grained	24.1
20							
		X	SPT 6	1-1-1	23	Dark gray, sandy SILT; soft, wet	36.0
25							
		X	SPT 7	2-2-7	29.5	Dark gray, silty SAND; medium dense, wet, fine grained	34.5
30							
		X	SPT 8	9-7-4	33	changes to medium grained	27.5
35							
		X	SPT 9	5-5-8	39.5		33.5

COMPLETION DEPTH: 24.0 **DEPTH TO WATER IN BORING:** 6.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 7/280122.GPJ MINE.GDT 7/13/98

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SEA402536

BORING LOG NO. 3

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL
						Boring completed at 39.5 feet on June 24, 1998; Groundwater encountered at 6.0 feet.
45						
50						
55						
60						
65						
70						
75						

COMPLETION DEPTH: 24.0 **DEPTH TO WATER IN BORING:** 6.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 712801?2.GPJ MINE.GDT 7/13/98

KCSlip4 35992

SEA402537

BORING LOG NO. 4

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL	MOISTURE CONTENT (%)
					0.25	3 inch ASPHALT pavement	
						Dark gray, silty SAND; medium dense, moist with gravel and traces of wood debris (fill)	
		X	SPT 1	2-2-1			31.7
5					5	Dark gray, silty SAND; loose, wet (native)	
		X	SPT 2	1/18"			51.5
		X	SPT 3	7-7-2	9	Dark gray sandy SILT; soft, wet	38.8
10							
					13.5	Dark gray, silty SAND; loose, wet	
		X	SPT 4	0-1-6			27.1
15					15	Boring completed at 15.0 feet on June 24, 1998; Groundwater encountered at 6.0 feet.	
20							
25							
30							
35							

COMPLETION DEPTH: 6.5 **DEPTH TO WATER IN BORING:** 6.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 71280122.GPJ MINE.GDT 7/13/98

KCSlip4 35993

SEA402538

BORING LOG NO. 5

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL	MOISTURE CONTENT (%)
						Dark brown, silty SAND; dense, moist with gravel (fill)	
					2.5	Dark gray, clayey SILT; medium firm, moist with fine grained sand (native)	
5		X	SPT 1	3-3-3			36.2
		X	SPT 2	5-12-16	8.5	Dark gray, silty SAND; medium dense, wet	26.2
10		X	SPT 3	7-12-18			28.4
15					14.5	Boring completed at 14.5 feet on June 24, 1998; Groundwater encountered at 6.0 feet.	
20							
25							
30							
35							

COMPLETION DEPTH: 15.0 **DEPTH TO WATER IN BORING:** 6.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 71280122.GPJ MINE.GDT 7/13/98

KCSlip4 35994

SEA402539

BORING LOG NO. 6

King County International Airport
Seattle, Washington

Project: Proposed N.E. T-Hangars **Project Number:** 712-80129

Drilling Method: Hollow Stem Auger/SPT Split Spoon Sampler **Boring Location:** See figure 2

DEPTH, FT	SYMBOL	SAMPLES	SAMPLE ID	BLOW COUNTS/6 IN.	DEPTH, FT	DESCRIPTION OF MATERIAL	MOISTURE CONTENT (%)
						Dark brown, silty SAND; medium dense, moist, fine grained (fill)	
		X	SPT 1	3-3-5			29.2
5					5	Dark gray, silty SAND; dense, wet, medium grained (native)	
		X	SPT 2	10-15-14			26.6
10							
		X	SPT 3	7-19-23			27.1
15					14.5	Boring completed at 14.5 feet on June 24, 1998; Groundwater encountered at 7.0 feet.	
20							
25							
30							
35							

COMPLETION DEPTH: 19.0 **DEPTH TO WATER IN BORING:** 7.0 **ELEVATION:** 16.0

DATE: 6/24/98 **LOGGED BY:** L. Costa

BL SEATTLE 71280122.GPJ MINE.GDT 7/13/98

KCSlip4 35995

SEA402540

APPENDIX B

LABORATORY TEST RESULTS

MOISTURE CONTENT TEST
(ASTM D 4959-89)

Client: King County Airport
Client Representative: Jeff Winter, P.E.
Project Name: NE T-Hanger
Performed by: H. Hua
Reviewed by: S. Yaghmaie, P.E.

P.S.I. No: 712-80129
Date tested: 7/6/98

Sample No.	Location	Tare No.	Description	Wet Wt. (+ tare)	Dry Wt. (+ tare)	Tare Wt.	% Moisture
S-1A	B - 1	2	Brown silty sand	688.5	621.5	373	26.96
S-1B	B - 1	1B	Silty sand	694	648	373.5	16.76
S-2	B - 1	4	Sandly	651.5	595	359.5	23.99
S-3	B - 1	5	Sandly	928	849	557.5	27.10
S-4	B - 1	A	Dark sand	890.5	783	355.5	25.15
S-5	B - 1	4C	Dark sand	895	787	313	22.78
S-6	B - 1	G12	Dark sitly sand	687.5	599.5	318	31.26
S-7	B - 1	#10	Dark sand	645.5	570.5	344	33.11
S-1	B - 2	G	Sandly	701	654	319.5	14.05
S-2	B - 2	S	Sand & some gravel	517.5	477.5	316.5	24.84
S-3	B - 2	E-1	Dark sand	1337	1250	895.5	24.54
S-4	B - 2	S-10	Sand & some gravel	648.5	549.5	128.5	23.52
S-5	B - 2	11	Dark sand	671.5	577.5	223	26.52
S-6	B - 2	P-11	Silty sand	930	802	479.5	39.69
S-7	B - 2	C-10	Dark sand	632.5	522	211.5	35.59
S-1	B - 3	B1	Sandly	626	590	318	13.24
S-2	B - 3	4C	Sand & some gravel	567.5	514.5	313	26.30
S-3	B - 3	P-3	Sand & some gravel	933	860	534	22.39
S-4	B - 3	S	Brown sand	710	633.5	316.5	24.13
S-5	B - 3	P-11	Dark sand	997.5	897	479.5	24.07
S-6	B - 3	11	Silty sand	620	515	223	35.96
S-7	B - 3	C-10	Silty sand	679	559	211.5	34.53
S-8	B - 3	B1	Silty sand	719	632.5	318	27.50
S-9	B - 3	#10	Silty sand	689	602.5	344	33.46
S-1	B - 4	C-2	Organic sand & gravel	603.5	546.5	366.5	31.67
S-2	B - 4	G	Sand & silty	492	433.5	320	51.54
S-3	B - 4	G12	Silty sand	604.5	524.5	318.5	38.83
S-4	B - 4	P-2	Dark sand	987	903.5	595.5	27.11
S-1	B - 5	B5/S1	Silty sand	152.5	114.5	9.5	36.19
S-2	B - 5	5A	Silty sand	1092	1003.5	665.5	26.18
S-3	B - 5	B5/S3	Dark sand	238	187	7.5	28.41
S-1	B - 6	B6/S1	Brown silty sand	370	289.5	13.5	29.17
S-2	B - 6	E2	Silty sand	1035	982	783	26.63
S-3	B - 6	B6/S3	Sand & some gravel	438.5	346.5	7.5	27.14

:HH:hh(80129.report.doc)

KCSlip4 35997

SEA402542

SIEVE ANALYSIS
(ASTM C-136)

Client: King County International Airport
Client Representative: Jeff Winter, P.E.
Project Name: NE T-Hangars
Performed by: H. Hua
Reviewed by: S. Yaghmaie, P.E.

P.S.I. No.: 712-80129
Date tested: 7/6/98

Sample No.	Location	Description	Dry Weight (gm.)	Wt. Retained on #200 Sieve (gm.)	Percent Passing # 200 Sieve
3	B-1	Silty SAND	849	840	1.1
4	B-2	Silty SAND	549.5	528	3.9
3	B-3	Silty SAND	860	847	1.5
4	B-4	Silty SAND	903.5	897	7.2
2	B-5	Silty SAND	1003.5	993	1.0
2	B-6	Silty SAND	982	976.5	0.6

APPENDIX C

LABORATORY CHEMICAL ANALYSIS

NORTH CREEK ANALYTICAL
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PORTLAND ■ (503) 906-9200 ■ FAX 906-9210

PSI - Seattle	Project:	#712-80129	Sampled: 6/24/98
3257 16th Ave. West	Project Number:	Not Provided	Received: 6/25/98
Seattle, WA 98119	Project Manager:	Donald Balmer	Reported: 7/7/98 11:46

ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
B-1/S-2	B806537-01	Soil	6/24/98
B-2/S-2	B806537-02	Soil	6/24/98
B-3/S-2	B806537-03	Soil	6/24/98
B-4/S-2	B806537-04	Soil	6/24/98
B-5/S-1	B806537-05	Soil	6/24/98
B-6/S-2	B806537-06	Soil	6/24/98

orth Creek Analytical, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

irk Gendron, Project Manager

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East 11115 Montgomery, Suite B, Spokane, WA 99206-4776
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KCSlip4 36000

SEA402545

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PSI - Seattle	Project:	#712-80129	Sampled: 6/24/98
3257 16th Ave. West	Project Number:	Not Provided	Received: 6/25/98
Seattle, WA 98119	Project Manager:	Donald Balmer	Reported: 7/7/98 11:46

Hydrocarbon Identification by Washington DOE Method WTPH-HCID
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
B-1/S-2			**B806537-01**				**Soil**	
Gasoline Range Hydrocarbons	0680845	6/26/98	6/26/98		20.0	ND	mg/kg dry	
Diesel Range Hydrocarbons	"	"	"		50.0	ND	"	
Heavy Oil Range Hydrocarbons	"	"	"		100	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*83.5*	%	
B-2/S-2			**B806537-02**				**Soil**	
Gasoline Range Hydrocarbons	0680845	6/26/98	6/26/98		20.0	ND	mg/kg dry	
Diesel Range Hydrocarbons	"	"	"		50.0	ND	"	
Heavy Oil Range Hydrocarbons	"	"	"		100	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*101*	%	
B-3/S-2			**B806537-03**				**Soil**	
Gasoline Range Hydrocarbons	0680845	6/26/98	6/26/98		20.0	ND	mg/kg dry	
Diesel Range Hydrocarbons	"	"	"		50.0	ND	"	
Heavy Oil Range Hydrocarbons	"	"	"		100	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*85.5*	%	
-4/S-2			**B806537-04**				**Soil**	
Gasoline Range Hydrocarbons	0680845	6/26/98	6/26/98		20.0	ND	mg/kg dry	
Diesel Range Hydrocarbons	"	"	"		50.0	**DET**	"	
Heavy Oil Range Hydrocarbons	"	"	"		100	**DET**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*87.2*	%	
-5/S-1			**B806537-05**				**Soil**	
Gasoline Range Hydrocarbons	0680845	6/26/98	6/26/98		20.0	ND	mg/kg dry	
Diesel Range Hydrocarbons	"	"	"		50.0	ND	"	
Heavy Oil Range Hydrocarbons	"	"	"		100	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*82.8*	%	
-6/S-2			**B806537-06**				**Soil**	
Gasoline Range Hydrocarbons	0680845	6/26/98	6/26/98		20.0	ND	mg/kg dry	
Diesel Range Hydrocarbons	"	"	"		50.0	ND	"	
Heavy Oil Range Hydrocarbons	"	"	"		100	ND	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*86.2*	%	

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**Refer to end of report for text of notes and definitions.*

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PSI - Seattle	Project:	#712-80129	Sampled: 6/24/98
3257 16th Ave. West	Project Number:	Not Provided	Received: 6/25/98
Seattle, WA 98119	Project Manager:	Donald Balmer	Reported: 7/7/98 11:46

Diesel Hydrocarbons (C12-C24) and Heavy Oil (C24-C40) by WTPH-D (extended)
North Creek Analytical - Bothell

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
B-4/S-2			**B806537-04**				Soil	
Diesel Range Hydrocarbons	0780074	7/2/98	7/6/98		50.0	**552**	mg/kg dry	1
Heavy Oil Range Hydrocarbons	"	"	"		125	**3840**	"	
Surrogate: 2-FBP	"	"	"	*50.0-150*		*84.4*	%	

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PSI - Seattle	Project:	#712-80129	Sampled:	6/24/98
3257 16th Ave. West	Project Number:	Not Provided	Received:	6/25/98
Seattle, WA 98119	Project Manager:	Donald Balmer	Reported:	7/7/98 11:46

Dry Weight Determination
North Creek Analytical - Bothell

Sample Name	Lab ID	Matrix	Result	Units
B-1/S-2	B806537-01	Soil	65.9	%
B-2/S-2	B806537-02	Soil	65.1	%
B-3/S-2	B806537-03	Soil	64.4	%
B-4/S-2	B806537-04	Soil	48.9	%
B-5/S-1	B806537-05	Soil	59.9	%
B-6/S-2	B806537-06	Soil	65.0	%

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PSI - Seattle	Project:	#712-80129	Sampled: 6/24/98
3257 16th Ave. West	Project Number:	Not Provided	Received: 6/25/98
Seattle, WA 98119	Project Manager:	Donald Balmer	Reported: 7/7/98 11:46

Hydrocarbon Identification by Washington DOE Method WTPH-HCID/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit / Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 0680845	**Date Prepared: 6/26/98**					**Extraction Method: HCID (WA)**				
Blank	**0680845-BLK1**									
Gasoline Range Hydrocarbons	6/26/98			ND	mg/kg dry	20.0				
Diesel Range Hydrocarbons	"			ND	"	50.0				
Heavy Oil Range Hydrocarbons	"			ND	"	100				
Surrogate: 2-FBP	"	*DET*		*DET*	"	*50.0-150*	*83.8*			

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PSI - Seattle	Project:	#712-80129	Sampled: 6/24/98
3257 16th Ave. West	Project Number:	Not Provided	Received: 6/25/98
Seattle, WA 98119	Project Manager:	Donald Balmer	Reported: 7/7/98 11:46

Diesel Hydrocarbons (C12-C24) and Heavy Oil (C24-C40) by WTPH-D (extended)/Quality Control
North Creek Analytical - Bothell

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit / Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 0780074	**Date Prepared: 7/2/98**					**Extraction Method: EPA 3550B**				
Blank	**0780074-BLK1**									
Diesel Range Hydrocarbons	7/3/98			**ND**	mg/kg dry	**10.0**				
Heavy Oil Range Hydrocarbons	"			**ND**	"	**25.0**				
Surrogate: 2-FBP	"	*11.0*		*9.71*	"	*50.0-150*	*88.3*			
LCS	**0780074-BS1**									
Diesel Range Hydrocarbons	7/3/98	66.7		63.4	mg/kg dry	60.0-140	95.1			
Surrogate: 2-FBP	"	*11.0*		*10.3*	"	*50.0-150*	*93.6*			
Duplicate	**0780074-DUP1**		**B806599-01**							
Diesel Range Hydrocarbons	7/3/98		220	190	mg/kg dry			50.0	14.6	
Heavy Oil Range Hydrocarbons	"		1230	1090	"			50.0	12.1	
Surrogate: 2-FBP	"	*16.6*		*13.4*	"	*50.0-150*	*80.7*			

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Notes and Definitions

#	Note
1	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
Recov.	Recovery
RPD	Relative Percent Difference

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